Complete Summary

GUIDELINE TITLE

Selection of device, administration of bronchodilator, and evaluation of response to therapy in mechanically ventilated patients.

BIBLIOGRAPHIC SOURCE(S)

American Association for Respiratory Care (AARC). Selection of device, administration of bronchodilator, and evaluation of response to therapy in mechanically ventilated patients. Respir Care 1999 Jan;44(1):105-13. [76 references]

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Pulmonary disease

GUIDELINE CATEGORY

Assessment of Therapeutic Effectiveness
Evaluation
Treatment

CLINICAL SPECIALTY

Pulmonary Medicine

INTENDED USERS

Respiratory Care Practitioners

GUIDELINE OBJECTIVE(S)

- To improve the consistency and appropriateness of respiratory care and serve as a guide for education and research.
- To provide clinical practice guidelines on selection of device, administration of bronchodilator, and evaluation of response to therapy in mechanically ventilated patients.

TARGET POPULATION

Mechanically ventilated patients with documented or suspected bronchoconstriction or increased airways resistance

INTERVENTIONS AND PRACTICES CONSIDERED

Device selection, bronchodilator administration, and evaluation of response to therapy during mechanical ventilation.

- Devices include metered dose inhaler (MDI) with adapter and chamber or inline elbow and catheter; pneumatic nebulizer; small volume nebulizer (SVN) large volume nebulizer (LVN); ultrasonic nebulizer.
- Aerosolized bronchodilators include inhaled beta-adrenergic and anticholinergic bronchodilators (i.e., inhaled isoproterenol hydrochloride, isoetharine mesylate, metaproterenol sulfate, fenoterol, albuterol, ipratropium).

MAJOR OUTCOMES CONSIDERED

Clinical response, including vital signs, lung function as reflected by changes in peak inspiratory pressure (PIP), plateau pressure (Pplat), auto-PEEP (PEEPi), and bedside observations

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Not stated

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Not stated

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not applicable

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Consultants to the Working Group may review the initial draft of the guideline. After completion by the Working group, the draft is reviewed by the entire Steering Committee and then by a Review Panel, persons engaged in all facets of the delivery of respiratory care who have volunteered to review drafts of the Guidelines before publication.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Synopsis: Recommendations for Bronchodilator Delivery during Mechanical Ventilation

1. Ventilator Settings
Caution: If gas other than that from the ventilator is used to power the nebulizer, that flow may affect the delivered tidal volume, the inspired oxygen concentration, and the patient's ability to trigger the ventilator. It may be

necessary to decrease the set tidal volume. For a patient triggering the ventilator, the rate may need to be increased to maintain an appropriate minute ventilation

Recommendations: Consider the following, if not otherwise contraindicated--(1) Use of a tidal volume > 500 mL for adults; (2) addition of an inspiratory pause or lower flows, which may improve pulmonary deposition of aerosol; however clinical judgment and patient evaluation must assure that the patient's inspiratory flow demands are met (ie, the inspiratory-to-expiratory-time ratio is subjectively and physiologically appropriate and auto-PEEP is not increased);(3) because spontaneous breaths may improve aerosol deliver, spontaneous breathing should not be suppressed during aerosol therapy unless the patient's ability to trigger the ventilator is affected.

2. Humidifier Use
Caution: Use of an external gas source to power the nebulizer may cause heated circuit malfunction; (2) an artificial nose, or heat-and-moisture exchanger, must be removed before aerosol therapy is begun.

Recommendations: Although humidified gas has been shown to reduce aerosol delivery by as much as 40%, the humidifier should remain inline because of the risks associated with the delivery of dry gas. An increase in aerosol dose may compensate for this effect.

3. Metered Dose Inhaler Use
Caution: The dose delivered from an MDI is reduced significantly by failure to actuate the inhaler with the onset of inspiration.

Recommendations: (1) Use an MDI fitted with a chamber device; (2) actuate the MDI manually and synchronize actuation with the beginning of inspiration; (3) 4 puffs are the usual recommended dose; however, greater doses may be required when clinical monitoring of the patient suggests incomplete or inadequate response.

4. Nebulizer Use
Cautions: (1) Do not leave athe nebulizer inline between aerosol treatments; (2) change the nebulizer every 24 hours; (3) do not rinse the nebulizer with tap water.

Recommendations: (1) When possible place the nebulizer 30 cm from the proximal end of the endotracheal tube; (2) it may be necessary to add a filter in the expiratory limb of the circuit to maintain expiratory flow-sensor accuracy when large doses of aerosol are delivered by nebulizer.

5. Patient Monitoring
Monitor the response to therapy with each treatment.

- For volume ventilation: peak inspiratory pressure and the difference between peak inspiratory pressure and plateau pressure; for pressure ventilation: tidal volume.
- Auto-PEEP
- Peak expiratory flow and/or flow-volume loop

- Breath sounds

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

Not specifically stated for each recommendation: The guideline is developed from a thorough review of the literature, surveys of current practice, and the expertise of the members of the working group.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Effective bronchodilator aerosol administration and evaluation of response for treatment of bronchoconstriction or increased airways resistance in mechanically ventilated patients

POTENTIAL HARMS

- Specific assessment procedures may have inherent hazards or complications: (eg, inspiratory pause, expiratory pause).
- Inappropriate device selection or inappropriate use of device and/or technique variables may result in underdosing.
- Device malfunction may result in reduced drug delivery and may possibly compromise the integrity of the ventilator circuit.
- Complications of specific pharmacologic agents. Higher doses of beta agonists delivered by an MDI or nebulizer may cause adverse effects secondary to systemic absorption of the drug or propellants. The potential for hypokalemia and atrial and ventricular dysrhythmias may exist with high doses in critically ill patients.
- Aerosol medication, propellants, or cold, dry gas that bypasses the natural upper respiratory tract may cause bronchospasm or irritation of the airway. Although the efficiency of aerosol delivery from an MDI can be increased by actuating the canister into a narrow gauge catheter with the catheter positioned at the end of the endotracheal tube. A study in rabbits has shown that such introduction produces necrotizing inflammation and mucosal ulceration, probably from the topical effect of the oleic acid used for its surfactant property and the chlorofluorocarbons (CFCs). Such administration is not recommended. The results of further study are needed to support or condemn this practice.
- The aerosol device or adapter used and technique of operation may affect ventilator performance characteristics and/or alter the sensitivity of the alarm systems.
    1. Addition of gas to the ventilator circuit from a nebulizer may increase volumes, flows, and peak airway pressures, thus altering the intended

pattern of ventilation. Ventilator setting adjustments made to accommodate the additional gas flow during nebulization must be reset at the end of the treatment.
2. Addition of gas from a nebulizer into the ventilator circuit may result in the patient's becoming unable to trigger the ventilator during nebulization, leading to hypoventilation.

- At least one early anecdotal report described cardiac toxicity due to CFCs used as propellants in MDIs. Adverse cardiac effects are unlikely to occur with doses recommended in clinical practice because of the short half life of CFCs in the blood (< 40 s), particularly when at least a short interval is maintained between successive doses.

CONTRAINDICATIONS

CONTRAINDICATIONS

- Some assessment maneuvers may be contraindicated for patients in extremis (eg, prolonged inspiratory pause for patients with high auto-PEEP).
- Certain medications may be contraindicated in some patients. Consult the package insert for product-specific contraindications.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better
Living with Illness

IOM DOMAIN

Effectiveness
Safety

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

American Association for Respiratory Care (AARC). Selection of device, administration of bronchodilator, and evaluation of response to therapy in mechanically ventilated patients. Respir Care 1999 Jan;44(1):105-13. [76 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1999 Jan

GUIDELINE DEVELOPER(S)

American Association for Respiratory Care - Professional Association

SOURCE(S) OF FUNDING

American Association for Respiratory Care (AARC)

GUIDELINE COMMITTEE

Bronchodilator Administration during Mechanical Ventilation Working Group

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Jon Nilsestuen PhD RRT, Chairman; James Fink MS, RRT; Dean Hess PhD, RRT; James Volpe II Med RRT.

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

According to the guideline developer, this version has been reviewed within the last five years and is considered current.

An update is not in progress at this time.

GUIDELINE AVAILABILITY

Electronic copies: Available from the American Association for Respiratory Care (AARC) Web site.

Print copies: Available from AARC, CPG Desk, 11030 Ables Ln, Dallas, TX 75229-4593.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- The AARC Clinical Practice Guidelines. Respir Care 1996;41(7):647-53.

Print copies: Available from the American Association for Respiratory Care (AARC), CPG Desk, 11030 Ables Ln, Dallas, TX 75229-4593; Web site: www.aarc.org.

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on April 25, 1999. The information was verified by the guideline developer on April 25, 1999.

COPYRIGHT STATEMENT

Date Modified: 11/8/2004